Platform Cooperativism Consortium

INSTITUTE FOR THE COOPERATIVE DIGITAL ECONOMY

FARMING ALONE? RETHINKING DIGITAL PLATFORMS, COLLECTIVE ACTION, AND AGRICULTURAL MECHANIZATION IN SUB-SAHARAN AFRICA

A Report by
Katarzyna Cieslik

About the Institute for Digital Cooperative Economy (ICDE)

The Institute conducts cross-disciplinary research about the emerging cooperative digital economy, which is relatively uncharted territory in anthropology, political science, sociology, history, law, and economics. This rapidly expanding field is also inextricably linked to labor and cooperative studies. This work is concerned with finance, entrepreneurship, and organizational studies in business schools. Governance and corporate structure are critical subjects in law schools. The Institute's mission, in recognition of existing research gaps, is to provide applied and theoretical knowledge, education, and policy analysis.

To learn more, visit:

https://platform.coop/who-we-are/

Executive summary

- **Mechanization remains a key challenge** in many sub-Saharan African countries, despite numerous government-led and private-sector-driven initiatives. While tractor ownership has increased, it has largely benefited commercial farmers, while **smallholders remain excluded** from mechanization gains.
- **Peer-to-peer rental models are emerging** as a promising alternative to facilitate mechanization access, allowing smallholders to rent equipment from private owners. These models can be enhanced by appropriate **digital solutions** that are tailored to the realities of informal economies.
- **The rise of digital technologies offers new opportunities** to improve smallholder livelihoods, including **digital matchmaking and asset-sharing platforms** that connect machinery owners with users for a fee.
- This report builds on examples from Kenya and Ghana to **evaluate the potential of digital platforms in improving smallholder access to mechanization.** Our analysis highlights the **critical role of collective action** in making these services viable for smallholders.
- **We note that the majority of current smartphone-based applications tend to target individual users, yet smallholder farming is inherently collective.** Given the small, fragmented, and often remote nature of landholdings, individual smallholders do not generate sufficient demand to attract mechanized service providers. When farmers act collectively (e.g. coordinate on-farm activities), they become viable clients, ensuring greater efficiency and economic feasibility for service providers.
- **We also provide an extensive overview of diverse farmer collectives**, including cooperatives, farmer-based organizations (FBOs), grower associations, savings groups, and women's groups. Historically, only registered groups such as FBOs and cooperatives facilitated access to mechanization services. However, the rapid expansion of private-sector peer-to-peer rental models has enabled **informal collaborative groups to mobilize members for collective tractor hiring**, even when this is not directly linked to their core function.
- Smallholders are **leveraging a variety of social networks and organizational structures** to mobilize collective action for mechanization access. Whether through formal cooperatives or informal neighbourhood alliances, these groups are vital in overcoming barriers to mechanization. **Digital messaging apps such as WhatsApp, Telegram, Viber, WeChat and Messenger play a crucial role** in improving communication and subsequently collective organizing among farmers.
- **Finally, we present an overview of existing digital tools designed for agricultural collectives** such as **Musoni, Chamasoft, Taimba, Agripool and CoopFarming** and provide policy recommendations for governments to foster sustainable growth in the sector.

Recommendations

Public sector

- **Strengthen the integration of cooperatives and farmer-based organisations (FBOs) into private-sector led digital mechanization initiatives** by leveraging existing state structures, such as agricultural extension services and cooperative support institutions
- **Support and promote digital solutions for cooperatives and FBOs** that encourage digital platforms to target farmer groups rather than individuals. This can include subsidies, grants, or preferential funding for platforms that integrate cooperative structures
- **Support and incentivize responsible, inclusive digital innovation** that builds on user-driven digital solutions and align with smallholder realities and the collective nature of smallholder farming
- **Strengthen the enabling environment for digital mechanization services** – invest in rural infrastructure (e.g., mobile connectivity and electricity access) to facilitate the adoption and scalability of digital tools (including communicators) in remote areas

Private sector: Agri-tech companies & service providers

- **Invest in digital solutions for farmer collectives, cooperatives and FBOs** – design tools that accommodate group-based bookings, transparent cost-sharing, and cooperative finance
- **Engage farmer organizations in digital tool co-design** to ensure digital services reflect local needs, reduce adoption barriers, and enhance long-term sustainability
- **Strengthen service delivery for the 'last mile' users** by partnering with state agricultural extension services and financial institutions to improve accessibility and equity, ensuring that smallholders can access and afford digitally enabled mechanization services

Third Sector: NGOs and development agencies

- **Leverage existing state structures to strengthen farmer groups' participation and internal governance** – collaborate with agricultural extension institutions that have longstanding expertise in organizing and supporting farmer groups, rather than creating parallel structures
- **Facilitate digital literacy and capacity-building programs** – organize digital skills training for FBOs and farmer cooperatives, ensuring equitable access, especially for women, youth and other marginalized groups
- **Bridge the gap between farmers and digital service providers** – development organizations can act as intermediaries, fostering partnerships between FBOs and private sector actors, while advocating for inclusive digital solutions that address smallholder needs

1. Introduction: transforming smallholder farming with digital tools?

'Unity farming is all about the farmers coming together. Us coming together, aiming to achieve a certain goal in farming. Maybe I do not have the resources, but through us, we can get the resources if we farm together. Or maybe through our unity, we can be able to afford what we cannot afford in terms of the machinery that we use in farming'.

(Sogakope, Gana, 6th July 2023, woman tractor operator)

Access to agricultural mechanization remains a critical challenge for smallholder farmers in the Global South, limiting productivity, efficiency, and resilience in the face of climate variability (Daum and Birner 2017). In a number of countries in Sub-Saharan Africa where smallholder farming dominates, the lack of affordable and accessible mechanization perpetuates labour-intensive practices and restricts farmers' ability to expand production, undermining livelihoods (Adekunle 2016). While mechanization is often framed as a driver of agricultural transformation (Breuer et al. 2015), its adoption is hindered by high costs, fragmented landholdings, and inadequate institutional support (Daum and Birner 2020). Recently, emerging technological innovations, such as digital matching platforms for asset sharing, have been recognized as potential pathways to bridge this gap (Daum et al. 2021).

The rapid advancement of digitalization in rural Africa has sparked significant interest and investment in Information and Communication Technology for Agriculture (ICT4Agr) (Njuguna et al. 2025, Birner et al., 2021). As a result, there has been a surge in digital agricultural tools (apps), particularly in countries like Ghana, Kenya, Uganda, Nigeria and South Africa, driven by the idea of 'leapfrogging' traditional agricultural transition processes. Digital tools promise to bypass conventional barriers to agricultural development and accelerate improvements in productivity, efficiency, and farmers' livelihoods (Lajoie-O'Malley et al., 2020; Munthali et al., 2018). Proponents of ICT4Agr emphasize the role of digital tools as essential mechanisms for ensuring equitable and timely access to crucial agricultural resources (Aker 2011). These include advisory services for farmers, real-time weather forecasts, and market intelligence, all of which are critical in improving productivity and resilience in agricultural systems (Cieslik et al. 2018, Munthali et al. 2018).

At the same time, recent literature highlights persistent challenges and unmet expectations regarding the adoption of digital agricultural innovations in Sub-Saharan Africa (Abdulai et al., 2023; McCampbell et al., 2022, 2023). While mainstream analyses often attribute low uptake and non-adoption to farmers' supposed lack of digital literacy, risk aversion, or infrastructural barriers (Abate et al., 2023; Ayim et al., 2022; Kudama et al., 2021; Smidt & Jokonya, 2022), these explanations overlook deeper structural issues. In this report, we

explore the critical, yet underexplored factor of target user misalignment: the predominant design of digital tools is geared toward individual farmers rather than collective structures such as cooperatives or farmer-based organizations (Ngissah et al., forthcoming). Farmer-based organizations (FBOs), farmer associations, and cooperatives have a long-standing tradition in Sub-Saharan Africa, serving as vital mechanisms for collective action, resource pooling, and advocacy (Salifu and Funk 2012, Salifu et al. 2010, Sumelius & Tenaw 2008). For decades, such collective organizations have played a crucial role in strengthening the bargaining power of smallholder farmers, improving access to inputs, credit, and markets, and fostering community-driven agricultural development, and often receiving significant government support (Wanyama et al. 2009).

In this report, we draw on insights from our recent research project examining the challenges and opportunities of digital matching platforms in facilitating smallholders' access to agricultural mechanization in Sub-Saharan Africa. Using observations and reflections from the project, we compare two contrasting approaches to implementing digital interventions from Kenya and Ghana. Our analysis draws attention to the fact that digital agricultural applications marketed as transformative tools for smallholder farmers overwhelmingly target individual users rather than collectives (Ngissah et al, under submission). Most digital platforms are built around smartphone-based interfaces, which inherently cater to individual engagement (Parthiban et al. 2020). This approach overlooks the realities of smallholder farming, which is often characterized by resource scarcity, reliance on informal networks for labour-sharing and work exchange, and collective decision-making within associations, cooperatives or farmer-based organizations (Ochieng et al. 2018, Sumelius & Tenaw 2008, Porter and Lyon 2006, Hussi et al. 1993). The struggles of smallholders, including fragmented landholdings, limited bargaining power in input and output prices, and restricted access to finance, are more effectively addressed through collective organizing rather than individual adoption of a certain kind of app (Wanyama et al. 2009). By failing to integrate collective structures into their design and implementation, many digital platforms reinforce an individualized model of agricultural development that does not align with the socio-economic realities of smallholder farming, ultimately limiting their effectiveness and scalability.

Existing research already suggests that digital tools are more likely to empower the wealthier commercial farmers producing crops for export than smallholders (Daum et al. 2021). A significant gap remains between the promotional narratives touting the transformative potential of digital agricultural platforms and their actual, research-evidenced impacts on smallholders' livelihoods, household incomes, and farm productivity (Adewopo at al. 2025, Gumbi et al. 2023). By shifting the focus from presumed farmer deficiencies to the structural limitations of digital innovations themselves, we challenge

dominant narratives around technology adoption and calls for a reorientation toward models that better align with existing collective agricultural practices. In this way, this report makes several key contributions to the discussion on smallholder farmers' access to mechanization in Sub-Saharan Africa:

First, we critically assess the enduring importance of collective action in all aspects of smallholder farming, from bargaining power to input access, with a particular focus on mechanization (Abdul-Rahaman & Abdulai 2020, Fischer and Qaim 2014). While farmer associations remain essential for overcoming structural barriers, the report also appraises the challenges they face in the contemporary agricultural landscape, including organizational constraints, financial sustainability, equity issues and shifting donor priorities (Missiame et al. 2023, Gyau et al. 2016).

Second, the report sheds new light on the contested topic of agricultural digitalization as a revolutionary force shaping agricultural transitions in developing countries (Parthiban et al. 2020). While technological advancements, improved infrastructure, and increased connectivity have fuelled optimistic narratives of an 'ICT4Agr revolution' and 'technological leapfrogging' in food production, our findings suggest that these digital innovations have yet to deliver transformative change for smallholder farmers (Tabe-Ojong et al. 2023). Despite the widespread promotion of digital solutions tailored to smallholders, many of these technologies primarily benefit commercial farmers with larger landholdings, reinforcing existing inequalities rather than dismantling them (Daum et al. 2021)

Third, we contribute to the growing literature on digital platforms as key actors in the 'sharing economy'. While digital asset sharing platforms reduce the need for farmers to own physical assets like machinery, they are for-profit businesses and thus they simultaneously charge fees, moderate transactions, and control access to critical services. Although platform-based intermediation (Oreglia & Srinivasan 2020, Foster et al. 2019) can lower transaction costs for farmers, it also introduces risks of monopolization, data extraction, and value appropriation (Kenney et al. 2020). By positioning themselves as intermediaries in agrarian relations, digital platforms shape the broader agricultural ecosystem in ways that warrant closer scrutiny.

Finally, the report provides a comprehensive overview of digital tools designed for farmer cooperatives, outlining both their potential to enhance collective access to mechanization and the limitations that hinder their effectiveness. It formulates concrete policy recommendations grounded in responsible innovation and user-driven design frameworks, emphasizing the need for co-designed, contextually relevant solutions. To harness the opportunities presented by expanding digitalization—such as declining technology costs,

improved connectivity, and broader user adoption—solutions must be carefully crafted in collaboration with local stakeholders and end-users. Avoiding top-down, quick-fix approaches is crucial to ensuring that digital interventions address the complexities of agricultural transformation at the grassroots level, rather than merely appealing to donor-driven narratives of technological progress.

2. Mechanization and its challenges in sub-Saharan Africa

According to global estimates, there is an average of 200 tractors per 100 km^2 of arable land. In Sub-Saharan Africa, the average number of tractors per 100 km^2 is between 13 and 27, highlighting a significant mechanization gap (Baudron et al. 2015). Limited access to mechanization has profound consequences for smallholder farmers, leading to under-cultivation and income losses, translating into low productivity (Bor & Deng, 2024, Adu-Baffour et al., 2018, Gumbe 2015). Despite numerous state-led and private-sector led mechanisation attempts, progress has been slow due to a number of barriers, including high initial investment costs, restricted access to credit, limited technical expertise, and inadequate infrastructure, remain (Müller et al. 2017, Benin 2015). Governance challenges and market inefficiencies in spare parts supply and a lack of skilled operators and technicians, further exacerbate the problem (Daum and Birner 2017, Sims & Kienzle, 2016, Kahan et al. 2018; see Table 1 for an overview).

Table 1. Challenges to agricultural mechanisation – an overview

High costs and financial constraints	Smallholder farmers often struggle to afford mechanized equipment, even under subsidized schemes. The volatility of agricultural markets, coupled with unpredictable expenses and external shocks, result in repayment defaults and disintegration of leasing arrangements.
Farm size and geographic dispersion	The fragmented nature of smallholder farms (remote locations and small plot sizes) reduces the economic viability of mechanization. Long distances to fields increase fuel consumption and operator costs, making service provision inefficient. This is further exacerbated by the risk of tractor damage while in transit (poor road infrastructure).
Seasonal demand and operational bottlenecks	Mechanization services experience intense seasonal demand, as farmers require land preparation, planting, and harvesting within narrow timeframes dictated by the seasons and limited by weather variability. This leads to competition for limited machinery, resulting in delays and inefficiencies.
Weak institutional coordination and trust deficits	Social coordination challenges hinder effective mechanization adoption. Farmers may misreport land sizes to attract tractor services, while the absence of transparent allocation systems (i.e. plot measurement) fosters distrust and inefficiencies in machinery scheduling.
Market and infrastructure failures	Weak supply chains for spare parts, inadequate maintenance facilities, and poor road networks limit the availability and sustainability of mechanization.

Presently, after years of limited attention, agricultural mechanization has re-emerged as a priority in Africa's development agenda (Ayele 2022, Diao et al. 2019). In recent years, tractor ownership has risen significantly in Sub-Saharan Africa, particularly among commercial and medium-scale farmers who not only use machinery on their own land but also engage in peer-to-peer rental services (Jayne et al. 2019, Diao and Takeshima 2020, Diao et al. 2014). This shift is closely linked to broader socio-economic transformations, including the decline of extended family compound farms and the resulting reorganization of farm labour (Amanor & Iddrisu, 2022). While peer rental services have created new avenues for mechanization, they have notable limitations, particularly for smallholder farmers (Van Loon et al. 2020). With farm sizes typically less than 2 hectares and often geographically dispersed, smallholders are not considered viable clients (Kansanga 2018). When factoring in fuel costs, travel time, and the potential risk of tractor damage on uneven terrain, providing services to individual small-scale farmers is generally unprofitable for both private tractor owners and state-run for-profit mechanisation centres (Daum et al. 2020, Diao et al. 2019, Hussou et al. 2017, 2014, 2013). As a result, mechanization remains concentrated among larger, commercially oriented farmers, reinforcing existing disparities in access to modern agricultural technologies (Cabral and Amanor 2022, Kirui and von Braun 2018).

To overcome these challenges, collective action can be seen as a critical strategy for smallholders seeking mechanization services (Salifu et al. 2010). By coordinating their farming activities and forming organized groups, neighbouring smallholders can present a larger, contiguous area for ploughing, thereby reducing the logistical and financial burden on service providers. This approach not only improves smallholder access to mechanization but also allows them to negotiate more competitive rates, making mechanized farming a more viable option within small-scale agricultural systems (Tab. 2).

Table 2. Benefits of collective action for smallholder farmers in accessing mechanization services

Stage of on-farm production	Challenges for individual farmers	Benefits of collective action
Field preparation (ploughing, land clearing, ridging)	High costs due to small plot size and remote locations. Difficulty attracting tractor services due to unprofitability for operators. Scheduling conflicts during peak season.	Banding together (neighbouring plots) reduce travel and fuel costs for tractor owners and operators Improved bargaining position for preferential ploughing rates. Improved scheduling efficiency through coordinating demand.
Sowing and planting	Timing constraints: unpredictability of tractor availability creates backlogs and hampers planning efforts Delayed sowing and planting resulting in lower yields	Coordinated sowing enhances efficiency and allows optimal use of operator's time Higher likelihood of timely service, improved planning and logistics, improved yield
Harvesting and post-harvest handling	Delays in harvesting due to fragmented demand. Postharvest losses increase when harvesting is not timely. Limited availability of yield transport services	Coordinated harvesting reduces inefficiencies. Collective storage and processing facilities enhance market opportunities.
Market access and logistics	Higher transportation costs due to small, dispersed harvests. Weak bargaining power in price negotiations.	Aggregated produce leads to better market access and pricing. Shared logistics reduce transportation expenses.

3. Farming alone or farming together? Collective action benefits, challenges and organizations

Collective action as a response to structural challenges in agriculture

Smallholder farmers in SSA face significant constraints in accessing markets, inputs, credit, and agricultural information (Müller et al. 2017). Many researchers, activists and policymakers and donors view collective organizing as a critical mechanism to overcome these challenges, positioning it as a key component of broader processes of decentralization, devolution, and privatization (Ochieng et al. 2018, Nyikahadzoi et al.

2011, Saifu et al. 2010, Markelova et al. 2009). Collective action emerges when individuals collaborate on joint initiatives to achieve outcomes that serve their shared interests and well-being. The economic theory of collective action focuses on the provision of public goods—resources, assets, and services that benefit multiple stakeholders—through cooperative efforts. For smallholder farmers, collective action may serve multiple purposes: enhancing smallholder farmers' access to credit through peer accountability, empowering them to advocate for policy support, and facilitating the sustainable management of shared resources such as pastures, water systems, and irrigation infrastructure, and agricultural machinery (Lupia and Sin 2003). However, while collective action has the potential to generate significant benefits, it does not always materialize due to challenges such as disparities in contributions and the free-rider problem, where some individuals benefit from collective resources without actively participating. (Tab. 3).

Table 3. Challenges to collective action by smallholders: the case of agricultural mechanisation

Type of challenge	Collective action problems	Outcomes
Competition for tractors during peak seasons	Farmers prioritize individual needs, fearing delays if they wait for group arrangements.	Unequal access to machinery, delayed ploughing, and reduced yields due to missed planting windows.
Mistrust and lack of coordination	Farmers may exaggerate land size to secure priority access, leading to inefficiencies.	Mechanization providers face scheduling difficulties, causing service disruptions and increased costs.
Unequal contribution to group efforts	Some farmers may attempt to free ride on collective arrangements without contributing equally (e.g. not preparing the field for ploughing, contributory payment delays)	Groups become unstable, leading to breakdowns in collaboration and reduced bargaining power with tractor owners and operators.
Fragmented and dispersed landholdings	Organizing neighbouring farmers is difficult due to geographical dispersion of small plots.	High logistical costs for machinery operators (i.e. missing road infrastructure, risks of tractor damage on uneven terrain) discourage service provision to smallholders.
Elite capture and power imbalances	Wealthier or influential farmers may dominate decision-making in group negotiations. Farmers with more financial resources may prefer private arrangements rather than collective rental schemes	Marginalized farmers receive fewer benefits, discouraging wider participation in collective efforts. Wealthier farmers access services more easily, widening inequality in mechanization benefits.

Extensive research highlights the crucial role of collective action in enabling smallholder farmers to overcome barriers to mechanisation by lowering transaction costs and addressing market constraints (Fischer & Qaim, 2014; Kibirige, 2016; Markelova et al., 2009; Nyikahadzoi et al., 2011). By organizing into cooperatives, farmer groups, or informal collectives, smallholders can pool resources to jointly rent or purchase agricultural machinery, reducing individual costs while improving access to essential equipment. Collective approach also enhances bargaining power, allowing farmers to negotiate better service rates and preferential treatment during critical planting and harvesting periods (Gyau et al. 2016). For this reason, both bottom-up (farmer-driven) and top-down (mobilized by public, private and third sector institutions) farmer organizations are key to effective collective action.

Farmer-based organizations, cooperatives, and informal associations

Cooperatives and farmer-based organizations play a significant role in agricultural development in Sub-Saharan Africa (Hussi et al. 1993). They can increase farmers' profits from crop sales and strengthen their position in the food value chain (Bernard et al., 2010, Sumelius & Tenaw, 2008). However, their effectiveness depends on a number of factors, including social institutions and social capital (Kibirige 2916), as well as enabling policies and direct government support (Bernard et al., 2010 Salifu et al., 2010, Hussi et al., 1993).

Historically, cooperatives and farmer-based organizations have played a crucial role in supporting smallholder farmers across Sub-Saharan Africa (Boda et al. 2024). Their evolution, however, has been shaped by complex political and institutional. Initially introduced by colonial administrations as mechanisms to organize smallholders for the production and marketing of cash crops, cooperatives were designed to serve the economic interests of the colonial state (Ortmann & King 2007). These early cooperatives focused primarily on facilitating the production of export commodities, such as cocoa, cotton, and coffee (Holmén 1990). Following independence, many African governments saw cooperatives as vital tools for rural development, using them to provide agricultural credit, distribute inputs, and regulate market access. At times, this state-driven approach led to excessive government control, limiting farmer agency and undermining the cooperatives' governance autonomy (Boone 1995). For instance, research has showed that centralized pricing policies and state-controlled marketing boards frequently undermined cooperatives' financial sustainability, leading to inefficiencies and, at times, their eventual decline (Woods 1999). Despite these setbacks, cooperatives have remained a critical feature of African agriculture, evolving in response to shifting economic and political landscapes.

The development and impact of agricultural cooperatives have varied significantly across countries, with Ghana and Kenya offering distinct yet instructive examples. In Ghana, cooperatives have been closely tied to the cocoa sector, in line with the government's long-standing prioritization of cocoa production as a key driver of agricultural development in the country (Ludlow 2012). While membership in cooperatives guaranteed input access and market outlets for participating farmers, government oversight often meant that farmers had little control over pricing and overall decision making. Similarly, in Kenya, political interference and governance challenges often undermined the efficiency of the coffee and tea cooperatives, with institutions and policies aligning more with state interests over farmer welfare (Wanzala et al. 2022, Tshishonga & Okem 2016). Both countries illustrate the dual nature of cooperatives in Africa—as vehicles for economic development and farmer empowerment. Research suggests that with strong institutional support, democratic governance, and economic incentives, cooperatives have the potential to enhance not only agricultural productivity but also rural political and economic development (Nakayiso and Andrew 2023).

In the past, only farmer-based organizations (FBO) and farmer cooperatives were formally recognized as legitimate structures that could channel state support and development assistance. However, in recent years, there has been a diversification of organizational models beyond traditional cooperatives, driven by farmers themselves, as well as the private sector actors and the third sector. A growing number of agribusiness firms, NGOs, and social enterprises now mobilize farmers into groups to enhance their bargaining power, facilitate bulk purchasing of inputs, and improve access to finance and markets. These new forms of collective action often operate with greater flexibility than state-supported cooperatives and leverage digital platforms, contract farming arrangements, and out-grower schemes to integrate smallholders into commercial value chains. Contrary to the mainstream research on agricultural collectives which stresses longevity and identity-forming narrative as defining features of FBOs and coops, recent research defines these new organisations as rather loose groups that are 'assembled and re-assembled from bundles of socioecological relations, (that) enrol myriad actors and marshal diverse resources to their cause, and (…) start and disperse according to no single, overarching logic (Fisher and Nading 2021: 1232). While this shift has expanded opportunities for farmers, it also raises questions about long-term sustainability, equity, and the balance of power between smallholders and external actors (Tab. 4)

Tab. 4. Type of collective organizations in Sub-Saharan Africa

Type	Definition	Main Features	Examples
Farmer-based organizations (FBOs)	Community-based groups of smallholder farmers that collaborate for mutual benefit.	Engage in input procurement and bulk purchasing. - Provide extension services and market linkages. - Often engage in joint storage, processing, and sales.	Village-level farmer groups, district agricultural unions.
Agricultural cooperatives	Legally registered groups formed to support agricultural production, marketing, and financing.	Operate based on democratic governance. - Offer shared resources such as machinery, inputs, and storage. - Provide credit and savings opportunities.	Dairy cooperatives, grain cooperatives.
Crop associations	Groups of farmers growing the same crop or producing the same commodity.	Focused on knowledge sharing and advocacy. - Provide technical support and training. Engage in collective bargaining for input supply and market access.	Coffee Growers' Associations, Cotton Producers' Associations.
Savings and credit associations (saccos)	Groups formed to provide financial services, especially microfinance, to farmers.	Facilitate savings and loan access for agricultural investment. - Support financial literacy and business planning. Sometimes linked to larger financial institutions.	Rural SACCOs, village savings and loan associations (VSLAs).
NGO-facilitated farmer groups	Groups supported by non-governmental organizations for capacity building and market access.	Focus on skills development and sustainability. - Often involved in climate-smart agriculture and agroecology. - Some provide access to donor-funded grants and infrastructure.	Farmer field schools, NGO-led agribusiness clusters.
Contract farming organizations	Partnerships where farmers enter into agreements with agribusiness firms or processors.	Farmers commit to producing specific crops under agreed conditions. - Companies provide inputs, technical support, and guaranteed market access. - Can reduce risks for smallholders but may limit flexibility.	Tobacco contract farming schemes, sugarcane out-grower schemes.
Pastoralist and livestock associations	Groups of livestock keepers advocating for grazing rights, market access, and animal health services.	Address mobility issues and land tenure security. - Provide veterinary services and cooperative marketing. - Engage in policy advocacy for pastoralist rights.	Cattle herders' associations, dairy farmer networks.
Women and youth farmer groups	Organizations focusing on empowering women and young people in agriculture.	Provide training, mentorship, and financial inclusion programs. - Address gender-specific challenges in agriculture. - Foster innovation, entrepreneurship, and value addition.	Women in Agribusiness networks, Youth Agripreneur associations.
Religious-based farmers' groups	Farming groups formed under religious institutions to support rural livelihoods.	Often linked to churches, mosques, or faith-based charities. - Focus on social welfare, food security, and community development. - May provide microfinance and training on sustainable farming.	Church-led farming initiatives, Islamic agricultural investment groups.
Labour-sharing and work exchange groups	Informal groups that assist each other with farm labour on a rotational basis.	Members work collectively on each other's farms. - Reduce labour costs and improve efficiency. - Often culturally embedded and based on mutual trust.	Traditional work parties like 'Nnoboa' in Ghana.

At the same time, the challenges and shortcomings of collaborative organizations should also be acknowledged. While participation in collective organizations is often regarded as a critical pathway out of rural poverty, members' success depends on their ability to manage substantial upfront costs - an obstacle that poorer farmers often struggle to overcome (Shonhe and Chinyoka 2023). In a recent paper, Takyiakwaa et al. (2024) explain how participation in such groups can in fact endanger livelihoods and deepen inequalities. They reveal how many poorer farmers struggle to afford the financial contributions required for collective action, while concerns over leadership transparency and potential mismanagement of resources further discourage participation. Unable to afford the participation fees required by associations, smallholders are often left to navigate market exchanges individually, which increases their vulnerability. In contrast, wealthier farmers are often able to overcome these barriers by forming informal networks with other well-off farmers, pooling resources to invest in income-generating opportunities such as mechanisation. As a result, participation becomes limited to those who can afford the costs, excluding the very farmers who would benefit the most.

With regards to agricultural mechanization specifically, **machinery rings** are meat to facilitate the shared use of agricultural machinery, allowing members to access equipment without the high costs of individual ownership and a feasible solution to smallholder farmers' mechanization challenges. **Most machinery rings are cooperatives**: they involve collective ownership and shared resources. By pooling resources, where members contribute fees, or pay per use, to access tractors and other essential machinery. **Some machinery rings can also be categorized as specialized FBOs**, since they focus on provisioning a particular service (machinery access). At times, **machinery rings, may also function as contract farming support organizations,** where private companies they provide mechanization services to specific farmers under agreements.

Benefits	Challenges
By sharing costs, farmers can reduce financial constraints, access machinery according to need, and increase their productivity without the risks associated with large capital investments: Lower costs of maintenance and repair services, ensuring that equipment remains in good condition. Training and capacity building opportunity for farmers willing to become tractor operators (at times). Improved cooperation and trust within participating farmer groups, strengthened social cohesion, enhanced shared decision-making.	Complex logistical coordination, competition for machine use during peak planting seasons, leading to potential delays and within-group conflict. Governance issues, such as disagreements over user schedules, pricing, or maintenance responsibilities. Within-group inequity whereby wealthy members attempt to dominate decision-making, reducing access options for smaller farmers Tradeoffs between strong management and collective action/trust. Vulnerability and shocks: some farmers default on their membership commitments due to shocks, such as crop failure.

4. The rise of digital apps

Over the past decade, the digital transformation of agriculture in Sub-Saharan Africa has become a focal point of development policy (Aker 2011, Furuholt and Matotay 2011). The rise of digital tools (apps) for farmers has been hailed as a potential game-changer, offering opportunities to enhance productivity, improve market access, facilitate financial inclusion, and bolster resilience against climate change (Birner et al. 2021). The widespread adoption of mobile phones, supported by significant improvements in infrastructure and enhanced connectivity resulted in increased penetration of internet services in rural areas. According to the World Bank, over 80% of Sub-Saharan African households now use mobile phones, and the mobile subscription rate in the region has increased from 29% in 2005 to over 82% in 2020. While the digital divide remains a concern (Misaki et al. 2018), the rapid adoption of mobile technology has enabled farmers to engage with a range of digitally enabled agricultural services, from crop management apps and market platforms to financial services and weather forecasts (Cieslik et al. 2018).

This shift is further supported by improved mobile network coverage, both urban and rural, which has made previously isolated farming communities more connected. The reduction of data costs by more than 70% over the last decade, has further expanded access to digital tools, even in low-income rural areas. Coupled with the increasing use of mobile money platforms like M-Pesa in Kenya, this has created an ecosystem where farmers can access vital information and services that were once out of reach. A plethora of agricultural tools ('apps') for farmers emerged, offering real-time information on crop management, livestock management, weather information as well as pricing information, and connecting smallholders to buyers (Njugna et al. 2025) (Tab. 5)

Tab. 5 Categorisation of digital tools for farmers

App category	Service	Examples
Extension services apps	Provide advisory services, educational content, and information on best farming practices	iCow: offers farming advice, livestock management tips
Information apps	Offer real-time data on market prices, weather forecasts, and other relevant data	AgriMarket: provides market prices. Weatherinfo: weather forecasts for farmers
Tailored advice apps	Provide personalized recommendations for agricultural inputs and practices based on farm data	FarmLogs: farm management tool with tailored advice on crop management, including fertilizers and pesticides AgriWebb: offers advice for farm operations.
Diagnostic apps	Help farmers diagnose plant diseases, pests, or other crop problems by analysing images or data	Plantix: identifies plant diseases and pests via uploaded photos. Tumaini: pest and disease identification tool.
Microfinance and credit apps	Provide access to credit, microloans, and savings services for farmers and cooperatives.	FarmDrive: helps farmers access credit Tulaa: offers microfinance for agricultural inputs
Matchmaking apps for resources	Connect farmers with necessary assets, such as machinery, labor, or land.	Hello Tractor: connects farmers with shared tractor services. Agri-Gator: helps farmers find machinery for hire, connects farmers with transport and logistics providers
Marketplace apps	Connect farmers directly with buyers, traders, or suppliers for selling produce	Maano: virtual farmers market, links small-scale farmers with produce buyers Twiga Foods: links farmers to buyers and retailers Taimba: connects farmers with wholesale buyers

Supply chain and logistics apps	Assist farmers with transportation and logistics for product delivery or inputs	AgriChain: helps with the logistics of farm-to-market supply chains. ColdHubs: provides cold storage services to reduce post-harvest losses
Insurance apps	Provide insurance services or products for farmers, often linked to weather patterns or crop failure	Kilimo Salama: weather-based insurance platform Pula: agricultural insurance products using weather data
Farm management apps	Help farmers with planning, managing, and optimizing farm operations and resources	Farmers Edge: provides farm management tools and data analytics. AgriWebb: helps with livestock and farm management.

Despite these advancements, the growth of digital tools in agriculture has not been without its challenges, and the promise of a revolution in African farming has not yet materialized as expected (Njuguna et al. 2025). While the mobile phone penetration rate among farmers is impressive, the actual uptake and use of specialized agricultural apps have been slow. A plethora of agricultural apps, developed by both the public and private sectors as well as non-profits, have flooded the market, each promising to solve critical challenges in the sector, but very few managed to sustain operations once the donor funding ceased. The 'fail to scale' problem has been documented in research (Ngissah et al., forthcoming)), as many agricultural apps fail to live up to the hype, struggling to become viable businesses due to low farmer adoption, limited scalability, and a lack of alignment with real on-the-ground needs.

Uberisation of agricultural mechanisation? The emergence of tractor hailing apps

Among the many apps, digital matching apps, at times called 'Uber for Tractors', aim to address one of the major challenges faced by smallholder farmers: access to scarce and costly agricultural machinery (Daum et al. 2020, 2021). Matching platforms connect farmers with tractor owners for a fee, facilitate transparent pricing and efficient scheduling, making the mechanisation service more accessible to smallholders. Often referred to as 'sharing economy' organizations, matching platforms are considered to be particularly useful to farmers who only require machinery during specific planting or harvesting periods, as it allows them to pay for services on-demand (Acquier et al. 2017, Tab. 4).

Tab. 4. Example digital apps for agricultural mechanisation

Name of App	Functionality
Hello Tractor	Connects smallholder farmers with tractor owners through a digital platform, enabling efficient tractor hire services
Trotro Tractor	Offers a mobile matchmaking application that links farmers with tractor owners willing to rent out machinery for a fee
RentEase	Provides affordable access to tractors and other agricultural machinery through flexible financing options
EM3 AgriServices	Operates a pay-per-use farming services platform, offering mechanization and other agricultural services to farmer.
farMart	Facilitates short-term rental of farm equipment, connecting equipment owners with smallholder farmers

Example I: 'Uber for tractors' apps in Ghana

Agricultural mechanization in Ghana faces significant challenges, with a substantial portion of farming operations still reliant on manual labour (Warren 2023). As of 2020, approximately 77.6% of farm activities were conducted manually (Benin 2015). There are over 8 million hectares of arable land in Ghana that would be suitable for mechanisation, but only 20% has been mechanized. Factors contributing to this include the high costs of machinery, limited access to affordable financing, and inadequate infrastructure to support mechanization services (Ströh de Martínez et al. 2016). Additionally, the uneven development of road infrastructure overlaps with the uneven distribution of mechanization services, further disadvantaging smallholder farmers (Akolgo et al. 2022). Against this background, the emergence of digital matching platforms for tractors sparked optimism in policy circles as well as donor communities: the operating model of tractor matching platforms mirrors that of urban ride-hailing services, with services generally offered on a pay-per-use basis, costs calculated per hectare, and GPS-referenced location tracking ensuring credibility and transparency.

Despite initial enthusiasm and strong donor support, the startups implementing the digital matching model for tractors struggled to deliver sustainable mechanization services in Ghana. In the case that we investigated, while the platform initially reported high user engagement and operations across multiple regions, its underlying business model proved unsustainable once donor funding ceased[1]. This can be attributed to a combination of structural, financial, logistical, and technological challenges that made long-term financial

1 We chose not to disclose the names of the agricultural apps that we looked at in this report.

viability impossible. Unlike the traditional ride-hailing model which capitalizes on an oversupply of drivers, there is severe shortage of tractors in Ghana, making it difficult to create a competitive, on-demand market. With far fewer tractors than needed, demand consistently outstripped supply, leading to service delays, unreliable availability, and growing trust issues with farmers. Second, the social-mission driven business model assumed catering to individual smallholders, especially women farmers, who often farm on remote, scattered plots, in order to empower them economically and socially. This proved financially unsustainable in the long-term: many of these farmers could not afford to pay for services upfront, making revenue collection uncertain and unpredictable. In addition, the high operational costs of dispatching tractors over long distances, coupled with volatile market conditions, meant that mechanization services often remained out of reach for the very farmers that needed the service the most. Without ongoing donor subsidies, the service struggled to remain afloat. Further, many farmers preferred relying on informal networks and personal relationships when hiring tractors and were hesitant to engage with a digital platform where trust in service reliability and pricing was uncertain (Kansanga 2017). Concerns over whether the tractors would arrive, whether the agreed pricing would be honoured, or whether the tractor operators would prioritize serving wealthier clients first, undermined adoption among smallholders. Finally, it is important to note that while smartphone penetration is increasing in Ghana, digital literacy remains a challenge in rural areas. Even though the service was available via USSD for feature phones, many farmers still struggled with the process, and despite the presence of field officers chose traditional booking methods through word-of-mouth informal networks. As a result, the startup managers needed to modify their approach to their innovation rollout and eventually ceased to provide the service altogether.

Tab. 5. Challenges faced by digital matching apps

Category	Challenge	Explanation
Mismatch between individualized services & collective farming	Targeting individual farmers instead of farmer groups	Many smallholder farmers in Africa operate within cooperative structures or informal farming groups, but digital platforms often focus on individuals, making coordination for collective hiring difficult.
Trust & adoption barriers	Lack of trust in digital platforms	Farmers, especially older ones, may be skeptical about the reliability of digital platforms, preferring established informal networks for mechanization access.
Cash & credit constraints	Limited access to upfront payment options	Many smallholder farmers lack immediate cash or credit access to pay for tractor services, making it difficult to adopt pay-per-use models.
Free-riding & coordination issues	Challenges in ensuring fair cost-sharing	In group-based hiring, some farmers may refuse to contribute their fair share after securing services, leading to conflicts and discouraging collective action.
Mechanization timing & demand clustering	High demand in peak seasons leads to supply shortages	Digital platforms struggle to meet demand spikes during planting and harvesting seasons, making tractor access unreliable
Infrastructure & connectivity gaps	Limited mobile and internet access in rural areas	Digital services rely on mobile apps or USSD codes, but poor network coverage in remote areas can limit adoption.
Mismatch between pricing & affordability	Dynamic pricing models may not suit smallholders	While platforms set per-hectare rates, farmers may find pricing inflexible and misaligned with their financial capabilities.
After-sales support & service reliability	Uncertainty around maintenance and repairs	If a rented tractor breaks down, there are often no guarantees for quick servicing, which disrupts farming schedules.
Digital & financial literacy gaps	Limited familiarity with digital payments and apps	Many farmers are unfamiliar with digital payment systems and mobile apps, creating barriers to smooth adoption.

Example II: farmer groups and access to mechanisation in Kenya

Similarly to Ghana, in Kenya, smallholder farmers, who constitute approximately 80% of the country's total agricultural output, face significant challenges in adopting mechanized farming practices (Kaumbutho and Takeshima 2023, Makini et al. 2017). The high costs associated with machinery, such as tractors and harvesters, render ownership unattainable for many, especially those operating on land plots of less than 2 hectares (Farm to Market Alliance, 2022). The challenges to increasing mechanisation rates are similar to the ones described above, and despite the many government efforts, labour-intensive hoe-farming still dominates (Mkomwa et al. 2023).

The emergence of digital matching platforms for tractors has generated optimism among policymakers and donors as a potential solution to smallholders' mechanization challenges (Kiaka & Kimana 2024). By facilitating efficient demand-supply matching, the platforms reduce downtime for tractor operators, optimize use within geographic vicinity and consequently lower costs and wait time for small-scale farmers (Kropff et al. 2023). Unfortunately, just like in Ghana, the approach proved inefficient in fragmented agricultural landscapes, and catering to individual smallholders small, remote farms parcels of land proved unsustainable. To overcome these limitations, a shift toward a group-based model emerged[2]. Instead of expecting bookings from individual farmers, the platform managers worked with community-based agents who not only actively promoted the service in remote rural areas but also **facilitated bulk requests on behalf of farmer cooperatives or organized groups. At times, the field agents even facilitated the creation of new farmer groups and following the clustered demand model**. This method proved effective and allowed for economies of scale, reducing transport costs for tractor operators and tractor owners, ultimately making mechanization service both more equitable and more sustainable.

An important aspect of this shift is the effort to reach farmers in underserved areas, often referred to as the 'last mile.' Many such farmers remain beyond the reach of conventional mechanization services as they are not considered viable clients. **By catering to collectives, instead of individuals, the digital matching platforms managed to successfully scale their intervention.** Allowing farmers to pay for tractor rentals in instalments channelled through group-based credit and cooperative saving schemes further increased adoption, expanding access for those who could not afford upfront fees. Furthermore, it is important to notice that the **success of these digital matching platforms relies heavily on the work of field agents and other on-the-ground personnel**, such as agricultural extension workers. This is in sharp contrast to the marketing

2 Please note that the app landscape changes dynamically: at the time this report goes to press, a number of digital matching platforms for tractor rental offer group-based services not just in Kenya, but also in Ghana, Nigeria and South Africa.

narrative of the platforms, which often attribute their success to the processes of digital reintermediation. Field agents and facilitators play a key role in bridging the gap between technology and smallholders, ensuring that bookings are made efficiently and that farmers understand their rights and responsibilities. This is important to note, as field agents are often overlooked by innovation managers and startups, who tend to focus on technological solutions rather than the human networks needed for effective implementation.

Tab. 6. Benefits of group-based model

Challenge category	Issues with individualized approach	Advantages of a group-based model
Targeting & accessibility	Platforms focus on individual farmers, but smallholders often rely on collective farming, making solo hires impractical	A group-based model would allow multiple farmers to pool resources and jointly hire a tractor, improving accessibility and ensuring efficient use of services
Trust & adoption barriers	Individual farmers may lack trust in unfamiliar digital platforms, preferring known local service providers	Farmer groups can build collective trust through shared experiences and recommendations, easing adoption
Cash & credit constraints	Many smallholders lack upfront cash or credit access to pay for tractor services	Groups can share costs, making payments more manageable, and leverage collective bargaining power for better financing options
Free-riding & cost-sharing	Individual farmers may struggle to bear the full cost of mechanization alone	Within a group, structured agreements ensure shared financial responsibility, reducing the risk of free riding
Mechanization timing & demand clustering	Individual bookings lead to inefficiencies and uncoordinated demand spikes during peak seasons	Groups can plan tractor use collectively, reducing inefficiencies and ensuring tractors are used optimally throughout the season
Infrastructure & connectivity	Digital platforms rely on individual mobile access, but rural areas often have poor connectivity	A group model reduces reliance on each farmer having digital literacy or internet access—leaders or representatives can manage bookings
Pricing & affordability	Per-hectare pricing models may be too costly for individual smallholders	Groups can negotiate bulk service discounts and distribute costs fairly among members
After-sales support & service reliability	Individual farmers may struggle to access repairs or replacements if a rented tractor breaks down	Groups can advocate collectively for better service agreements, ensuring quicker responses to mechanical issues
Digital & financial literacy gaps	Some farmers are unfamiliar with mobile apps and digital payments, limiting adoption	Group representatives can handle digital interactions on behalf of members, increasing overall participation and accessibility

5. Rethinking digital tools

The appeal of digital agricultural apps as revolutionary tools for African smallholder farmers remains strong, with policymakers and industry leaders frequently touting their potential to improve access to mechanisation, increase productivity, and foster sustainable livelihood strategies for smallholder farmers. However, despite significant investment and donor support, many of these platforms struggle to achieve widespread adoption and reach financial viability, raising questions about the gap between technological promise and on-the-ground impact. The vast majority of the agricultural platform firms fail to scale, and their impact on smallholder farmers' livelihoods has been limited. A report by the World Bank found that fewer than 20% of agricultural apps in the region are actively used after their initial launch phase. According to the recent estimates, worldwide, only 15 digital agricultural solutions have exceeded the 1 million registered users mark, and in many cases, only 15% to 30% of conscripted users are active users (60Decibele 2025). Against this background, the sector represents yet another exemplification of **Kentaro Toyama's 'law of amplification': technology alone cannot create new value; instead, it amplifies existing capacities (2015**). Where foundational capabilities and infrastructures are lacking, technology alone is unlikely to deliver sustainable development outcomes. In the case of African agriculture, many smallholder farmers face challenges that digital apps are unable to address on their own - issues such as lack of access to reliable infrastructure, financing, and market integration, and of course, the persistence scarcity of tractors.

These problems are not exclusive to matching or asset-sharing platforms. For example, apps like iFarm in Nigeria, which offer farm management solutions, have often been too complex or expensive for the vast majority of smallholders, who require simple, cost-effective solutions that account for the unique socio-economic challenges they face. Furthermore, many of these apps have been developed without sufficient local input or adaptation to the diverse and often specific needs of farmers. For instance, while some apps offer promising solutions for specific farming sectors (e.g., WeatherInfo app for crop forecasting), their impact has been limited by the inability to scale up across varied agro-ecological zones and varying crop cycles. While the widespread enthusiasm for technology in African agriculture underscores the potential of digital tools, it also highlights a critical lesson: **technology can only be truly transformative if it is integrated into broader development processes and existing social institutions.** Agricultural technology can amplify existing capacities, but it cannot replace the need for foundational infrastructure and systemic support. **Without the critical work of on-the-ground facilitators, extension officers and field agents, technology alone will not yield the long-term, sustainable development that is needed.**

6. Platforms for collective action

The examples from Ghana and Kenya highlight the need for digital solutions that are collective and incorporate existing institutions, such as FBOs and cooperatives. The connective function of mobile appliances remains underexplored by digital service providers, despite it's proven potential to improve collective action efforts (Munthali et al. 2018, 2021). By focusing on collective access rather than individual users and ensuring last-mile reach, the group-based model of digitally enabled tractor hire service proved more effective in increasing mechanization uptake among smallholders. Importantly, some digital agricultural apps designed for collectives - such as cooperatives, farmer groups, and savings associations - already exist, offering an alternative pathway to transforming African agriculture (Table 7). Smallholder farming is inherently collaborative, relying on shared resources, coordinated activities, and collective decision-making. By facilitating communication, joint planning, and resource pooling, these apps enable farmer groups to organize production more efficiently, improve access to inputs and machinery, and strengthen the members' bargaining power in negotiations with service providers and buyers. Some may also streamline logistics, improve access to financial services, and enhance knowledge-sharing, making smallholder farming more resilient and economically viable. Crucially, by building on existing social structures and traditional forms of cooperation, they foster relations of trust and increase adoption.

Tab. 7. Beyond mechanisation: example digital tools for FBOs, cooperatives and collectives

Digital tools for farmer groups	Function/capacity
AgroPonto	Agroponto is a virtual farmers market that connects all stakeholders in the food value chain—linking urban and rural areas, farms, and markets—where farmers, cooperatives, agro input dealers, wholesalers, and service providers can offer or seek agricultural goods and services.
ADAX Coop	An ERP solution designed for agricultural cooperatives, streamlining grain commodity trading, member accounting, agri-distribution, and input supply management.
MyEasyFarm,	MyEasyFarm supports arable farming cooperatives, traders, and agricultural consultants in assisting farmers with their agro-ecological transition.
Agrivi	Agrivi facilitates the digital transformation of collaboration with farms in a cooperative, providing farmers with data-driven agronomic advice, traceability, and crop marketing support through farmer contracting.

MyCoop	MyCoop provides access to tools and resources for improving farming practices, securing finance, and connecting with buyers
MazaoHub	MazaoHub is a digital agriculture platform that aims to digitize and revolutionize the operations of cooperatives and their AMCOS.
Twiga Foods	Connects smallholder farmers and vendors, enabling group-level supply chain management for cooperatives and farmer groups.
Hello Tractor	Facilitates shared tractor services between farmers, often organized by groups or cooperatives
Taimba	A platform where groups of farmers can sell their produce to urban retailers, reducing middlemen.
Agrikaab	Crowdfunding and e-commerce platform for livestock farming, often used by farmer cooperatives to collectively invest and sell.
AgriLedger	A blockchain-based tool for tracking and managing agricultural supply chains for farmer groups and cooperatives.
Tulaa	Provides credit to farmers for inputs, typically used by farmer cooperatives to support joint purchases.
ColdHubs	Solar-powered cold storage services for groups of farmers, helping reduce post-harvest loss and improve market access.
Agripool	Helps agricultural groups plan logistics and transportation to move goods efficiently, lowering operational costs.
mFarms	A platform designed to help farmer groups coordinate, access finance, and share knowledge.
Ekgaon	A platform for rural communities offering access to finance, markets, and collective services.

As an illustrative example, **digital apps designed for credit and savings cooperatives** play a crucial role in expanding financial inclusion for smallholder farmers and rural communities. By digitizing savings contributions, loan disbursements, and record-keeping, these platforms enhance transparency, reduce administrative burdens, and improve access to credit for members who may otherwise be excluded from formal banking systems. **They have been developed specifically to support the existing group-based financial models, such as rotating savings and credit associations (ROSCAs and SACCOs) and village savings and loan associations (VSLAs), which are essential for building financial resilience in informal economies.** By improving financial coordination, these apps empower cooperatives to provide more reliable and sustainable financial services to their members, supporting smallholders in investing in productivity, mitigating risk, and securing long-term economic stability (Tab. 8).

Tab. 8. Example apps for credit and savings cooperatives and associations

Digital tool	Function/capacity
Musoni	Musoni is a microfinance management software designed for SACCOs and financial cooperatives. It helps manage member savings, loans, and group accounts efficiently. This platform can be particularly useful for SACCOs in agricultural communities that offer credit and savings products to their members.
Chamasoft	Chamasoft is a mobile and web-based software designed for SACCOs, community savings groups, and investment clubs (called "chamas" in Kenya). It offers tools for managing savings, loans, member contributions, and interest payments, which are useful for agricultural cooperatives offering financial services to their members.
M-Shwari	M-Shwari is a mobile banking platform available in Kenya and part of the Safaricom M-Pesa ecosystem. It offers savings and loan products to individual members and groups. Agricultural SACCOs can use this platform to help their members access small loans and manage savings via mobile phones.
Tala	Tala is a mobile lending app that offers short-term loans. It's designed to assess creditworthiness based on users' mobile phone activity and financial behavior, making it accessible even to smallholder farmers who may not have formal credit histories. SACCOs or community-based lending groups can partner with Tala for providing accessible credit to members.
Branch	Similar to Tala, Branch is a mobile lending app that uses mobile data to assess borrowers' creditworthiness. It can be used by SACCOs or credit unions in agricultural communities to offer small loans to farmers, especially in regions with limited access to traditional banking services.
SaveMoney	SaveMoney is an app designed for community savings and loans. It provides digital tools to manage savings accounts, loans, and group savings. Agricultural cooperatives or SACCOs can use SaveMoney to allow their members to save for farming-related investments or apply for low-interest loans.
FarmDrive	FarmDrive is a platform that connects farmers with financing options by collecting and analyzing agricultural data. It helps SACCOs and other financial institutions assess the creditworthiness of smallholder farmers and make informed lending decisions. It aims to bridge the gap between agricultural communities and formal financial services.
Kiva	Although Kiva is an international platform, it can be adapted for use by agricultural SACCOs or lending groups. Kiva facilitates crowd-funded loans for small-scale farmers and cooperatives, which can then be distributed as microloans to members for farming activities. It's a great tool for community-based credit groups to provide access to external capital.
Farm Credit Express	Farm Credit Express offers agricultural finance solutions and loans for farmers. While not specifically designed for SACCOs, it can be used by agricultural cooperatives to manage loan products for farm equipment, seeds, and other inputs. It supports financial groups working within agriculture.
CoopFarming	CoopFarming is an agricultural cooperative app designed to help SACCOs and farming cooperatives manage group funds, provide loans to members, and track savings. The app helps ensure transparency and ease of communication among group members, making it easier for farming communities to manage their finances.

The rise of digital tools in agriculture in Sub-Saharan Africa presents a significant opportunity to transform farming practices, increase productivity, and improve rural livelihoods. To fully harness the potential of digital tools, more attention must be paid to understanding the local context, addressing infrastructural barriers, and ensuring that these solutions are adaptable, affordable, and accessible to smallholder farmers. The hype around agricultural apps needs to be tempered with a realistic understanding of the challenges smallholder farmers face and the recognition that technology, in isolation, cannot create the systemic change required for sustainable agricultural development in Africa.

Conclusion

In this report, we argued that agricultural mechanization continues to be a significant challenge for smallholder farmers sub-Saharan Africa, despite ongoing efforts by governments, NGOs and the private sector. Although tractor ownership has increased overall, the benefits of mechanisation are often concentrated among commercial farmers, leaving smallholders marginalized. Recently emerged peer-to-peer rental models offer a promising solution, enabling farmers to rent machinery from private owners on a commercial basis, but they remain beyond the reach of many smallholders. In this report, we argued that these models can be enhanced through digital solutions - such as matching apps – if these are tailored to meet the unique needs of smallholder farming.

The rise of digital technologies has opened new avenues for improving agricultural service delivery and supporting farmer livelihoods using private sector providers. Drawing on examples from Kenya and Ghana, we explored how digital platforms can facilitate smallholders' access to mechanization. We describe how the majority of digital solutions focus on individual users, while smallholder farming is inherently collective. Due to the fragmented and often remote nature of landholdings, some farmers are simply not viable clients for the service providers, be it through an app or the traditional arrangements through informal networks. Accordingly, we highlight the role of diverse farmer collectives, including cooperatives, farmer-based organizations (FBOs), and informal groups such as church associations, in overcoming barriers to mechanization, in aggregating demand, making the service more affordable, and thus more sustainable in the long term.

Ever since the Green Revolution, technology has been considered the key driver of agricultural transformation (Nin-Pratt and McBride 2014). While this approach resulted in crop yields in some regions, its impact on farmer livelihoods is much more contested, as technology alone cannot address the deeper institutional and organizational challenges they face. In the context of agricultural digitalization, we challenge the prevailing narrative

of technology as a simple solution for the agricultural transition in developing countries. To foster sustainable agricultural development, policies should prioritize strengthening social institutions, such as FBOs and cooperatives, ensuring they have the autonomy and capacity to engage with private sector digital providers as partners, fostering long-term sustainable development.

Abdul-Rahaman, A., & Abdulai, A. (2020). Farmer groups, collective marketing and smallholder farm performance in rural Ghana. Journal of Agribusiness in Developing and Emerging Economies, 10(5), 511-527.

Acquier, A., Daudigeos, T., & Pinkse, J. (2017). Promises and paradoxes of the sharing economy: An organizing framework. Technological Forecasting and Social Change, 125, 1-10.

Adekunle, A., Osazuwa, P., & Raghavan, V. (2016). Socio-economic determinants of agricultural mechanisation in Africa: A research note based on cassava cultivation mechanisation. Technological Forecasting and Social Change, 112, 313-319.

Adewopo, J., McCampbell, M., Mwizerwa, C., & Schut, M. (2025). Beyond the Hype: Ten Lessons from Co-Creating and Implementing Digital Innovation in a Rwandan Smallholder Banana Farming System. Agriculture, 15(2), 119.

Adu-Baffour, F., Daum, T., & Birner, R. (2019). Can small farms benefit from big companies' initiatives to promote mechanization in Africa? A case study from Zambia. Food policy, 84, 133-145.

Aker, J. C. (2011). Dial "A" for agriculture: A review of information and communication technologies for agricultural extension in developing countries. Agricultural Economics, 42(6), 631–647.

Akolgo, G. A., Quaye, D. N. D., Alhassan, A. R. M., Asosega, K. A., Nunoo, E., Akimsah Jedaiah, O. A., ... & Atta-Darkwa, T. (2022). Status of Agricultural Mechanization in Ghana: Insight from Farmers' Perception, Population, and Nonagricultural Sector Growth. Advances in Agriculture, 2022(1), 2094276.

Amanor, K. S., & Iddrisu, A. (2022). Old tractors, new policies and induced technological transformation: agricultural mechanisation, class formation, and market liberalisation in Ghana. The Journal of Peasant Studies, 49(1), 158-178.

Ayele, S. (2022). The resurgence of agricultural mechanisation in Ethiopia: rhetoric or real commitment? The Journal of Peasant Studies, 49(1), 137-157.

Ayim, C., Kassahun, A., Addison, C., & Tekinerdogan, B. (2022). Adoption of ICT innovations in the agriculture sector in Africa: a review of the literature. Agriculture & Food Security, 11(1), 22.

Baudron, F., Sims, B., Justice, S., Kahan, D.G., Rose, R., Mkomwa, S., Kaumbutho, P., Sariah, J., Nazare, R., Moges, G. & Gérard, B. (2015). Re-examining appropriate mechanization in Eastern and Southern Africa: two-wheel tractors, conservation agriculture, and private sector involvement. Food Security, 7(4), 889-904.

Benin, S. (2015). Impact of Ghana's agricultural mechanization services center program. Agricultural economics, 46(S1), 103-117.

Bernard, T., Spielman, D. J., Seyoum Taffesse, A., & Gabre-Madhin, E. Z. (2010). Cooperatives for staple crop marketing: evidence from Ethiopia: IFPRI research monograph No 164. Available at: https://cgspace.cgiar.org/server/api/core/bitstreams/8aea2833-267c-4e92-8ae6-54f079acbd01/content.

Birner, R., Daum, T., & Pray, C. (2021). Who drives the digital revolution in agriculture? A review of supply-side trends, players and challenges. Applied economic perspectives and policy, 43(4), 1260-1285.

Boda, C. S., Ekumah, B., Isgren, E., Akorsu, A. D., Armah, F. A., & Hombey, C. T. (2024). Every farmer is a farmer? A critical analysis of the emergence and development of peasant farmers Association of

Ghana. Geoforum, 150, 103995.

Bor, C., & Deng, K. (2024). Challenges and Opportunities of Tractor Adoption by Smallholder Farmers in Gambella Region, Ethiopia. International Journal of Mechanical Engineering and Applications, 12(5), 129-135.

Breuer, T., Brenneis, K., & Fortenbacher, D. (2015). Mechanisation–a catalyst for rural development in sub-Saharan Africa. Rural, 21(49), 2.

Boone, C. (1995). Rural interests and the making of modern African states. African Economic History, (23), 1-36.

Cabral, L., & Amanor, K. S. (2022). Tractors, states, markets and agrarian change in Africa. The Journal of Peasant Studies, 49(1), 129-136.

Cieslik, K. J., Leeuwis, C., Dewulf, A. R. P. J., Lie, R., Werners, S. E., Van Wessel, M., ... & Struik, P. C. (2018). Addressing socio-ecological development challenges in the digital age: Exploring the potential of Environmental Virtual Observatories for Connective Action (EVOCA). NJAS-Wageningen Journal of Life Sciences, 86, 2-11.

Daum, T. (2023). Mechanization and sustainable agri-food system transformation in the Global South. A review. Agronomy for Sustainable Development, 43(1), 16.

Daum, T., & Birner, R. (2017). The neglected governance challenges of agricultural mechanisation in Africa–insights from Ghana. Food Security, 9, 959-979.

Daum, T., & Birner, R. (2020). Agricultural mechanization in Africa: Myths, realities and an emerging research agenda. Global food security, 26, 100393.

Daum, T., Adegbola, Y. P., Kamau, G., Daudu, C., Zossou, R. C., Crinot, G. F., ... & Oluwole, F. A. (2020). Impacts of agricultural mechanization: Evidence from four African countries. Hohenheim Working Papers on Social and Institutional Change in Agricultural Development, Working Paper 003-2020. Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3672085.

Daum, T., Villalba, R., Anidi, O., Mayienga, S. M., Gupta, S., & Birner, R. (2021). Uber for tractors? Opportunities and challenges of digital tools for tractor hire in India and Nigeria. World Development, 144, 105480.

Diao, X., & Takeshima, H. (2020). Agricultural mechanization in Ghana: Alternative supply models for tractor hiring services. An evolving paradigm of agricultural mechanization development: How much can Africa learn from Asia, 377-400.

Diao, X., Cossar, F., Houssou, N., & Kolavalli, S. (2014). Mechanization in Ghana: Emerging demand, and the search for alternative supply models. Food Policy, 48, 168-181.

Diao, X., Cossar, F., Houssou, N., & Kolavalli, S. (2019). Unleashing the power of mechanization. Ghana's Economic and Agricultural Transformation. In: Diao, X., et al. (eds), Ghana's Economic and Agricultural Transformation: Past Performance and Future Prospects. Oxford: Oxford Academic.

Fischer, E., Qaim, M. (2014) Smallholder farmers and collective action: what determines the intensity of participation? Journal of Agricultural Economics 65(3): 683–702.

Fisher, J. B., & Nading, A. M. (2021). The end of the cooperative model (as we knew it): Commoning and co-becoming in two Nicaraguan cooperatives. Environment and Planning E: Nature and Space, 4(4), 1232-1254.

Foster, C., Graham, M., & Waema, T. M. (2019). Making sense of digital disintermediation and development: The case of the Mombasa tea auction. Digital economies at global margins, 55-78.

Furuholt, B. and Matotay, E. (2011). The developmental contribution from mobile phones across the agricultural value chain in rural Africa. The Electronic Journal of Information Systems in Developing Countries, 48 (1), 1-1.

Gumbe, L. (2015). Agricultural Mechanisation for Transformation. International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering, 9(5), 1742-1746.

Gumbi, N., Gumbi, L., & Twinomurinzi, H. (2023). Towards sustainable digital agriculture for smallholder farmers: A systematic literature review. Sustainability, 15(16), 12530.

Gyau, A., Franzel, S., Chiatoh, M., Nimino, G., & Owusu, K. (2014). Collective action to improve market access for smallholder producers of agroforestry products: key lessons learned with insights from Cameroon's experience. Current Opinion in Environmental Sustainability, 6, 68-72.

Gyau, A., Mbugua, M., & Oduol, J. (2016). Determinants of participation and intensity of participation in collective action: Evidence from smallholder avocado farmers in Kenya. Journal on Chain and Network Science, 16(2), 147-156.

Holmén, H. (1990). State, cooperatives and development in Africa. Nordic Africa Institute.

Houssou, N., Diao, X., & Kolavalli, S. (2014). Can the private sector lead agricultural mechanization in Ghana? (Vol. 4). Intl Food Policy Res Inst.

Houssou, N., Diao, X., Asante-Addo, C., & Kolavalli, S. (2017). Development Of the Capital Service Market In Agriculture: The Mergence Of Tractor-Hire Services In Ghana. The Journal of Developing Areas, 51(1), 241–257.

Houssou, N., Diao, X., Cossar, F., Kolavalli, S., Jimah, K., & Aboagye, P. O. (2013). Agricultural mechanization in Ghana: is specialized agricultural mechanization service provision a viable business model? American Journal of Agricultural Economics, 95(5), 1237-1244.

Hussi, P., Murphy, J., Lindberg, O., & Brenneman, L. (1993). The development of cooperatives and other rural organizations: The role of the World Bank. Available at: https://documents.worldbank.org/en/publication/documents-reports/documentdetail.

Jayne, T. S., Muyanga, M., Wineman, A., Ghebru, H., Stevens, C., Stickler, M., ... & Nyange, D. (2019). Are medium-scale farms driving agricultural transformation in sub-Saharan Africa? Agricultural Economics, 50, 75-95.

Kahan, D., Bymolt, R., & Zaal, F. (2018). Thinking outside the plot: insights on small-scale mechanisation from case studies in East Africa. The journal of development studies, 54(11), 1939-1954.

Kansanga, M. M. (2017). Who you know and when you plough? Social capital and agricultural mechanization under the new green revolution in Ghana. International Journal of Agricultural Sustainability 15: 6708–6723.

Kaumbutho, P., & Takeshima, H. (2023). Mechanization of agricultural production in Kenya: Current state and future outlook. In: Breisinger, C., Keenan, M., Mbuthia, J., Njuki, J. (eds). Food Systems Transformation in Kenya: Lessons from the Past and Policy Options for the Future,. 231-260. https://doi.org/10.2499/9780896294561_09.

Kenney, M., Serhan, H., & Trystram, G. (2020). Digitalization and platforms in agriculture: organizations, power asymmetry, and collective action solutions (No. 78). ETLA Working Papers.

Kiaka, R., & Kimana, R. V. (2024). Digital Technology in Kenyan Agriculture: A Scoping Report. Working Paper 67. Cape Town: Institute for Poverty, Land and Agrarian Studies, University of the Western Cape, South Africa, 10-11. Available at: https://plaas.org.za/wp-content/uploads/2024/05/Working-Paper-67-Digital-Technology-in-Kenyan-Agriculture-Kiaka.pdf.

Kibirige, D. (2016). Smallholder commercialization of maize and social capital in the social capital in the Eastern Cape. International Journal of Economics, Commerce and Management 4(9): 236–252.

Kirui, O., & von Braun, J. (2018). Mechanization in African agriculture: a continental overview on patterns and dynamics. ZEF. Available at: https://ageconsearch.umn.edu/record/273522/usage?v=pdf.

Kropff, W., Ortiz Crespo, B., Steinke, J., Tesfaye, L., Ramirez-Villegas, J., Ghosh, A., ... & Prager, S. D. (2023). Mainstreaming digital approaches for adaptation in agriculture in Kenya. CGIAR Global Centre on Adaptation. Available at: https://cgspace.cgiar.org/server/api/core/bitstreams/5965381f-0dc4-4e65-8cba-94252b5ad6c3/content

Kudama, G., Dangia, M., Wana, H., & Tadese, B. (2021). Will digital solution transform Sub-Sahara African agriculture?. Artificial Intelligence in Agriculture, 5, 292-300.

Lajoie-O'Malley, A., Bronson, K., van der Burg, S., & Klerkx, L. (2020). The future (s) of digital agriculture and sustainable food systems: An analysis of high-level policy documents. Ecosystem Services, 45, 101183.

Ludlow, H. (2012). Ghana, cocoa, colonialism and globalisation: Introducing historiography. Yesterday and Today, (8), 01-21.

Lupia, A., & Sin, G. (2003). Which public goods are endangered?: How evolving communication technologies affect the logic of collective action. Public choice, 117(3), 315-331.

Makini, F. W., Kamau, G. M., Mose, L. O., Ongala, J., Salasya, B., Mulinge, W. W., & Makelo, M. (2017). Status, Challenges, and Prospects of Agricultural Mechanisation in Kenya: The case of Rice and Banana value chains. FARA Research Results, 1(2), 24.

Markelova H, Meinzen-Dick R, Hellin J, et al. (2009). Collective action for smallholder market access. Food Policy 34(1): 1–7.

McCampbell, M., Adewopo, J., Klerkx, L., & Leeuwis, C. (2023). Are farmers ready to use phone-based digital tools for agronomic advice? Ex-ante user readiness assessment using the case of Rwandan banana farmers. The Journal of Agricultural Education and Extension, 29(1), 29-51.

McCampbell, M., Schumann, C., & Klerkx, L. (2022). Good intentions in complex realities: Challenges for designing responsibly in digital agriculture in low-income countries. Sociologia Ruralis, 62(2), 279-304.

Misaki, E., Apiola, M., Gaiani, S., & Tedre, M. (2018). Challenges facing sub-Saharan small-scale farmers in accessing farming information through mobile phones: A systematic literature review. The Electronic Journal of Information Systems in Developing Countries, 84(4), e12034.

Missiame, A., Akrong, R., & Appiah-Kubi, G. D. (2023). Collective action and farm efficiency of male-and female-headed farm households in Ghana. Cogent Social Sciences, 9(2), 2270844.

Mkomwa, S., Mutai, W., & Waswa, B. S. (2023). Mechanization Hire-Service Models for Conservation Agriculture in Kenya. Nairobi, Kenya: Alliance of Bioversity International and CIAT. Available at: https://hdl.handle.net/10568/135423.

Müller, C., Ströh de Martínez, C., & Brüntrup, M. (2017). Successful agricultural mechanisation in sub-Saharan Africa and the significance of agricultural financing No. 11/2017. IDOS Briefing Paper. Available at: https://www.idos-research.de/en/briefing-paper/article/successful-agricultural-mechanisation-in-sub-saharan-africa-and-the-significance-of-agricultural-financing/.

Munthali, N., Leeuwis, C., van Paassen, A., Lie, R., Asare, R., van Lammeren, R., & Schut, M. (2018). Innovation intermediation in a digital age: Comparing public and private new-ICT platforms for agricultural extension in Ghana. NJAS-Wageningen Journal of Life Sciences, 86, 64-76.

Munthali, N., Van Paassen, A., Leeuwis, C., Lie, R., van Lammeren, R., Aguilar-Gallegos, N., & Oppong-Mensah, B. (2021). Social media platforms, open communication and problem solving in the back-office of Ghanaian extension: A substantive, structural and relational analysis. Agricultural Systems, 190, 103123.

Nakayiso, E., & Andrew, N. (2023). A historical review on the global evolution, benefits, challenges and performance of cooperatives. Journal of Humanities and Social Sciences, 8(1), 51-75.

Ngissah, E., Freeman, C., Cieslik, K., and Leeuwis, C. (manuscript submitted to journal). Uberisation of Mechanisation: Exploring the Features and Establishment of Matchmaker Digital Tractor Hire Platforms in Ghana with Actor-Network Theory.

Nin-Pratt, A., & McBride, L. (2014). Agricultural intensification in Ghana: Evaluating the optimist's case for a Green Revolution. Food Policy, 48, 153-167.

Njuguna, E., Daum, T., Birner, R., & Mburu, J. (2025). Silicon Savannah and smallholder farming: How can digitalization contribute to sustainable agricultural transformation in Africa? Agricultural Systems, 222, 104180.

Nyikahadzoi, K, Siziba, S, Sagary, N, et al. (2011). Promoting effective collective marketing in the context of integrated agricultural research for development in Sub Saharan Africa. Learning Publics Journal of Agriculture and Environmental Studies 2(1): 82–97.

Ochieng J, Knerr B, Owuor G, Ouma, E. (2018). Strengthening collective action to improve marketing performance: evidence from farmer groups in Central Africa. The Journal of Agricultural Education and Extension 24(2): 169–189.

Oreglia, E., & Srinivasan, J. (2020). Human and non-human intermediation in rural agricultural markets. Journal of Cultural Economy, 13(4), 353-367.

Ortmann, G. F., & King, R. P. (2007). Agricultural cooperatives I: History, theory and problems. Agrekon, 46(1), 40-68.

Parthiban, R., Qureshi, I., Bandyopadhyay, S., & Jaikumar, S. (2020). Digitally mediated value creation for non-commodity Base of the pyramid producers. International Journal of International Journal of Information Management, 56, 102256.

Porter, G., & Lyon, F. (2006). Social capital as culture? Promoting cooperative action in Ghana. Routledge. In: Radcliffe, S. (ed.) Culture and Development in a Globalizing World: Geographies, Actors and Paradigms, 150-169, Routledge: Taylor & Francis .

Salifu A, Funk R (2012) Farmer based organizations in Ghana: how are they established and what do they do? Note 1. IFPRI: Ghana Strategy Support Programme. Available at: https://gssp.ifpri.info/files/2012/04/FBOs-in-Ghana.pdf.

Salifu, A., Francesconi, G. N., & Kolavalli, S. (2010). A review of collective action in rural Ghana. IFPRI Discussion Paper 00998. Available at: https://cgspace.cgiar.org/server/api/core/bitstreams/e0cd3ad0-a673-484a-83d2-a9a2bd5a664a/content.

Shonhe, T., & Chinyoka, I. (2023). Africa's policy and technology options: linking agricultural mechanisation to social protection targets. In: Mtapuri, O. (ed). Poverty, Inequality, and Innovation in the Global South, 35-59. Cham: Springer International Publishing.

Sims, B., & Kienzle, J. (2016). Making mechanization accessible to smallholder farmers in sub-Saharan Africa. Environments, 3(2), 11.

Smidt, H. J., & Jokonya, O. (2022). Factors affecting digital technology adoption by small-scale farmers in agriculture value chains (AVCs) in South Africa. Information Technology for Development, 28(3), 558-584.

Ströh de Martínez, C., Feddersen, M., & Speicher, A. (2016). Food security in sub-Saharan Africa: a fresh look on agricultural mechanisation. How adapted financial solutions can make a difference. Studies Deutsches Institut für Entwicklungspolitik and FAO (91). Available at: https://www.fao.org/sustainable-agricultural-mechanization/resources/publications/details/fr/c/456782/

Sumelius, J., & Tenaw, S. (2008). Cooperatives as a tool for poverty alleviation and food production in Sub-Saharan Africa. Nordic Association of Agricultural Scientists, 4 (7),109-113.

Tabe-Ojong Jr, M. P., Abate, G. T., Abay, K. A., & Spielman, D. J. (2023). Digital innovations and agricultural transformation in Africa: Lessons from Kenya. In: Breisinger, C/, Keenan, M., Mbuthia, J. and Njuki, J. (eds). Food Systems Transformation in Kenya: Lessons from the Past and Policy Options for the Future, 469-492. International Food Policy Research Institute.

Takyiakwaa, D., Tetteh, P. S. K., & Asante, K. T. (2024). 'Associations do not survive here': Inequality, Mistrust and Obstacles to Collective Action in Oil Palm Growing Communities in Ghana. Journal of Asian and African Studies, 0(0).

Toyama, K. (2015). Geek heresy: Rescuing social change from the cult of technology. Public Affairs.

Tshishonga, N., & Okem, A. E. (2016). A review of the Kenyan cooperative movement. Theoretical and Empirical Studies on Cooperatives: Lessons for Cooperatives in South Africa, 55-62.

Van Loon, J., Woltering, L., Krupnik, T. J., Baudron, F., Boa, M., & Govaerts, B. (2020). Scaling agricultural mechanization services in smallholder farming systems: Case studies from sub-Saharan Africa, South Asia, and Latin America. Agricultural systems, 180, 102792.

Wanzala, R. W., Marwa, N. W., & Nanziri, E. L. (2022). Historical analysis of coffee production and associated challenges in Kenya from 1893 to 2018. Southern Journal for Contemporary History, 47(2), 51-90.

Wanyama, F. O., Develtere, P., & Pollet, I. (2009). Reinventing the wheel? African cooperatives in a liberalized economic environment. Annals of public and cooperative economics, 80(3), 361-392.

Warren, F. (2023). Population density, urbanisation and agricultural mechanisation in modern Ghana. Review of

Development Economics, 27(3), 1605-1629.

Woods, D. (1999). The politics of organising the countryside: rural cooperatives in Côte d'Ivoire. The Journal of Modern African Studies, 37(3), 489-506.

Disclosure: We ideated and draft content in a text editor, refined the text with the aid of artificial intelligence tools like ChatGPT, and revised and edited it to reflect the intended message. All the ideas, analysis and conclusions are our own.

Acknowledgements

This report is based on a collaborative project between Wageningen University, University of Manchester and University of Ghana.

The team on this project also includes Dr Comfort Freeman, Prof. Cees Leewis, Dr Mariette McCampbell, Dr Nyamwaya Munthali and PhD Candidates: Naa Aku Mingle, Delali Woledzi and Ebenezer Ngissah.

The project received funding from the University of Wageningen, the Cambridge Philomathia Social Science Foundation and the International Science Partnerships Fund Institutional Support Grant (ODA) funding 2023 to 2024.

The author would like to express her gratitude to the Department of Agricultural Extension at the University of Ghana, the Cooperative University of Kenya and to Ms Anna Mukunya Mutinda from the Ministry for Cooperatives and Micro Small and Medium Enterprise Development of the State Department for Cooperatives, Kenya.

Published by the Institute for the Cooperative Digital Economy, June 2025
This research report is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International Public License.

Platform
Cooperativism
Consortium
INSTITUTE
FOR THE
COOPERATIVE
DIGITAL
ECONOMY